DOCUMENT RESUME

ED 065 791 CG 007 251

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TITLE	Sex, Personality, and Physiological Variables in the Communication of Emotion via Facial Expression.
REPORT NO	R-72-10
PUB DATE	69
NOTE	22p.
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	Behavioral Science Research; *Communication (Thought Transfer); Communication Problems; Communication Skills; *Individual Differences; *Nonverbal Communication; Physical Characteristics; *Sex Differences; *Visual Literacy

ABSTRACT

One goal of this study was to investigate sex differences in facial expressiveness. The study used all possible combinations of males and females in the positions of "sender" and "observer" of the facial communication to determine which factor was responsible for the superior accuracy among females, as reported in a previous study. Another goal of this study was to replicate the negative correlation found in the previous study between communication accuracy and physiological responding. Subjects were 32 female and 32 male undergraduates at the University of Pittsburgh. These subjects were run in 32 sender-observer pairs using a special apparatus and detailed procedure. The results indicated that female senders showed more accurate communication than male senders, but female observers were not reliably more accurate than male observers. The experimenter rated females as exhibiting more facial movement than males. This study replicated the findings of an earlier study which found a negative relationship between facial communication and skin conductance responding for males, but the correlation for females did not attain significance. (Author)

ED 065791

Sex, Personality, and Physiological Variables in the Communication of Emotion via Facial Expression

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Report No. 72-10

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Sex, Personality, and Physiological Variables in the Communication of Emotion via Facial Expression

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Psychologists have long recognized that people signal their feelings and emotions to each other by subtle movements, gestures and facial expressions. They have also recognized that a person's ability (or inability) to accurately "send" and "receive" these nonverbal messages must have important implications to his social and emotional life. Indeed, some of the earliest experiments on human emotion were focused on nonverbal communication (Gates, 1923; Landis, 1924). Unfortunately, most of these early efforts had to rely on static photographs of "emotional" people or posed enactments of emotional expressions, and they were not very successful.

Recent developments in television technology have led to a resurgence of experimental study in nonverbal communication. For example, Miller and his colleagues developed a paradigm around closed-circuit television for studying the communication of emotion via spontaneous facial expressions in monkeys (Miller, 1966; Miller, Caul, and Mirsky, 1967). Miller's paradigm has been successfully adapted to the study of humans by Gubar (1966) and Lanzetta and Kleck (1970), who used electric shock as emotional stimuli, and by Buck, Savin, Miller, and Caul (1969; in press) who used color slides.

The latter experiment involved showing a college student "sender" subject a series of emotionally-loaded color slides. Five distinct categories of slides were used: Sexual, Scenic, Pleasant people, Unpleasant, and Unusual. The procedure went as follows. A given slide was shown for ten seconds, then a light signaled the sender to verbally describe the emotional experience that the slide evoked in him. After 20 seconds, the slide was turned off and the sender rated his emotional experience along a Strong-Weak and a Pleasant-Unpleasant scale. This went on for 25 slides.

Unknown to the sender, his facial expressions and gestures as he looked at the slides were watched (without audio) by an "observer" subject via closed-circuit television. The observer judged what kind of slide the sender was watching (Sexual, Scenic, etc.), and he rated the sender's emotional experience along the Strong-Weak and Pleasant-Unpleasant dimensions. This yielded three measures of the accuracy of nonverbal communication between sender and observer: (a) the number of slides the observer categorized correctly, (b) the Pearson correlation coefficient between the sender's and observer's ratings of the strength of the sender's emotional experience, and (c) the correlation between their ratings of the pleasantness of the sender's emotional experience. Both the "Categorization measure" and the " Pleasantness measure" showed statistically significant nonverbal communication, with suggestive differences according to sex, personality, and physiological responding (Buck et. al., 1969; in press). The present experiment was designed to replicate and extend the findings of that study.

One goal of the present experiment was to investigate sex differences in facial expressiveness. The previous study found more accurate facial communication among females sending to females than among males sending to males. This could have been due to females being more facially responsive than males, to females being more sensitive to the facial responses of others than males, or both. The

present study used all possible combinations of males and females in the positions of "sender" and "observer" of the facial communication to determine which factor was responsible for the superior accuracy among the females.

Another goal of this study was to replicate the negative correlation found in the previous study between communication accuracy and physiological responding. The more a sender was facially responsive to the slides, the less reactive he was on skin conductance measures and, among females, the smaller her heart rate response. Following a distinction proposed by Jones (1935), persons high in skin conductance but low in facial responding were labeled "internalizers" while those who showed the opposite pattern were called "externalizers." This study attempted to replicate this negative relationship and study personality differences between internalizers and externalizers.

Method

Subjects

Subjects were 32 female and 32 male undergraduates recruited through the University of Pittsburgh student employment office. They were paid $2.50 for participation.

Procedure

Subjects were run in 32 sender-observer pairs. They were chosen randomly to fill the sender or observer position with the restriction that there were eight pairs each of males sending to male observers, males sending to females, females sending to males, and females sending to females. The apparatus and detailed procedure are described fully in a previous report (Buck et. al., in press).

The sender, observer and experimenter were in separate rooms during the experiment. The observer was scheduled to arrive 15 minutes before the sender. He was told to watch the sender's face over television and attempt to make

judgments about the kind of slides the sender was watching and how the sender felt about them. The observer was shown examples of the slides used as emotional stimuli.

When the sender arrived, he was told that the experiment concerned his physiological and subjective responses to different kinds of slides. He was told nothing about the observer or the hidden television camera. Heart rate and skin conductance electrodes were attached, and the sender was shown 25 slides including five slides in each of five categories. Sexual slides consisted of nude and semi-nude females and males, Scenic slides depicted landscales, Pleasant People were happy-looking children and adults, Unpleasant slides showed severe burns and facial injuries, and Unusual slides showed strange photographic effects and art objects. The slides had been categorized by 18 female and 18 male undergraduate raters.

A trial proceeded as follows. After a 10 second "Preslide period," a slide was presented to the sender for ten seconds with no signal to the observer ("Slide period"). A light then signalled the sender to verbally describe the emotional experience the slide evoked in him, and simultaneously a light signalled the observer that a slide was on. This period (the "Description period") lasted for 20 seconds. The lights and slide were then removed and the sender rated his emotional experience along nine-point Strong-Weak and Pleasant-Unpleasant scales ("Rating period"). Simultaneously, the observer made his ratings of the sender. He rated (a) what kind of slide the sender had seen on that trial, (b) the sender's emotional experience along a nine-point Strong-Weak scale, and (c) the sender's experience along a nine-point Pleasant-Unpleasant scale. When he finished the rating, the observer pushed a button signalling the experimenter and the next Preslide period began.

After the experiment, the sender and observer were brought together and fully debriefed. They were then each given a battery of personality questionnaires to complete, including the Budner intolerance of ambiguity scale, the Janis and Field self esteem scale, the Eysenck extraversion-intraversion scale, the Byrne repression-sensitization scale, the Alpert and Haber test anxiety scale, a 20-item form of the Taylor manifest anxiety scale, and the Marlowe and Crowne social desirability scale.

Dependent Variables

As in the Buck et. al. (1969; in press) study, the measures of communication accuracy were (a) the percent of slides the observer was able to correctly categorize (Categorization measure), (b) the correlation between the sender's and observer's ratings of the strength of the sender's emotional experience (Strength measure), and (c) the correlation between the sender's and observer's ratings of the pleasantness of the sender's emotional experience (Pleasantness measure).

In order to measure the sender's facial expressiveness independently of the idiosyncracies of different observers, the experimenter also watched the sender's face over television and rated on a five-point scale the amount of facial movement during the Description period for each slide.

The physiological records were analyzed in the Preslide period, the Slide period, and the first 10 seconds of the Description period. Mean heart rate in beats per minute, the number of skin conductance responses larger than 500 ohms, and the size of the largest skin conductance response in log micromhos were obtained for each period.

The sender's verbal descriptions of the emotional experience evoked in him by the slides were tape recorded. The descriptions to the first ten slides were later transcribed and rated by two persons who had no knowledge of the sender's performance in the experiment. The raters judged whether the sender described a personal emotional experience, referring both to himself and a feeling (The picture makes me feel calm, peaceful, and happy inside"), or whether the sender's description was impersonal, not referring to himself and often simply describing the content of the slide ("The picture doesn't make a strong impact. It's nice to look at, especially the lake."). Each description was rated as being "Personal," "Impersonal," or "not sure." The criterion of judgment was sufficiently objective that there was little disagreement between raters, and that was settled by mutual agreement.

Results

Sex Differences

Table 1 shows that both the Categorization measure and the Pleasantness measure of nonverbal communication showed values significantly greater than chance.

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More female senders showed significant communication than male senders on both the Categorization and Pleasantness measures. On the Categorization measure, 10/16 female vs. 4/16 male senders achieved significant Chi Squares ($\underline{X}^2$=3.17, $\underline{p} < .10$). On the Pleasantness measure, 11/16 female vs. 5/16 male senders achieved significant correlation coefficients ($\underline{X}^2$=4.50, $\underline{p} < .05$). The experimenter's ratings also indicated more facial movement among female than male senders ($\underline{t}$ = 2.34, $\underline{p} < .05$), although this could have been due to the experimenter's expectations. There were no significant differences between male and female observers.

Relationship between Facial Communication and Skin Conductance Responding.

Figure 1 shows the scatterplot between the change in the number of skin conductance responses from the Preslide to the Slide period, and the Pleasantness measure of communication accuracy. It reveals a general negative relationship

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between skin conductance responding and communication accuracy (Average r = -.50, Z = 2.92, $p < .005$). The individual correlation coefficients was significant for male senders (r = -.74, $p < .01$) but not females (r = -.17). Median splits for the two variables are superimposed on Figure 1, and senders above the median on communication accuracy and below the median on skin conductance responding are labeled "externalizers," while those showing the opposite pattern are called "internalizers." There was a tendency, which approached significance, for female senders to be externalizers and male senders to be internalizers (X^2 = 2.93, $p < .10$).

The number of slides on which the sender's verbal responses was rated as "personal" was also negatively related to skin conductance responding (Average r = -.41, Z = 2.32, $p < .025$). The individual correlation coefficient was again significant for male senders (r = -.58, $p < .05$) but not females (r = -.21). Thus, the data suggest a tendency, particularly among males, for frequent skin conductance responses to be associated with less facial expressiveness and a less personal verbal report of emotion.

The negative relationship between facial expression and skin conductance responding was found in a between-subject analysis, and it does not necessarily mean that the same sender would show less skin conductance response on slides where he had much facial expression. In fact, the opposite was apparently the case. The experimenter's rating of the sender's facial expression was positively correlated

with the size of the sender's skin conductance response over the 25 slides (Average r = +.15, Z = 3.75, p < .001). Thus, facial expression and skin conductance responding were found to be negatively related in a between-subject analysis but positively related in a within-subject analysis.

Relationship between Facial Communication and Heart Rate Responding

The general pattern of heart rate responding in this experiment was similar to that in the previous study. There was no significant change from the Preslide to the Slide period, but there was a significant (Z = 4.20, p < .001) acceleration, averaging 5.03 beats/min, between the Preslide period and the first 10 seconds of the Description period. The magnitude of this acceleration showed a negative relationship with the Pleasantness index of communication accuracy (Average r= -.35, Z = 1.96, p < .05). The individual correlation coefficients for the male and female senders did not attain significance (r = -.27 for males; r= -.43 for females).

Table 2 summarizes the relationships found between the pleasantness measure,

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verbal responses, skin conductance responses, and heart rate acceleration. The facial and verbal measures tended to be positively associated with each other and negatively related to the two physiological responses. This appears to substantiate and extend Jones's (1935) distinction between externalizers and internalizers.

Individual Differences between Internalizers and Externalizers

The identification of internalizers and externalizers is complicated by the fact that there is no absolute measure of communication accuracy or facial expressiveness in this experiment. Instead, there are several measures, each with potential strengths and weaknesses. The Pleasantness measure was used to identify

internalizers and externalizers in Figure 1, but this measure must reflect the characteristics of the different observers as well as the senders. The experimenter's rating of facial movement is independent of these influences, but it may be affected by experimenter expectations.

Because of the problems posed by each of these measures of facial expressiveness, both were used to identify internalizers and externalizers. The Pleasantness measure was used as in Figure 1. It revealed eight male and three female internalizers, four male and seven female externalizers, and four males and six females unclassified. The experimenter's ratings were used to identify externalizers and internalizers as follows. Senders above the median on the experimenter's rating and below the median on the change in the number of skin conductance responses from the Preslide to the Slide period were classified as externalizers, senders who showed the opposite pattern were labeled internalizers, and all others were unclassified. This revealed seven male and four female internalizers, three male and eight female externalizers, and six males and four females unclassified. As with the Pleasantness measure, there was a tendency for females to be classified as externalizers and males as internalizers ($\chi^2 = 2.93$, $p < .10$).

There were a total of eight differences in classification when the experimenter's rating was used instead of the Pleasantness measure to identify internalizers and externalizers. Three who were externalizers using the Pleasantness measure became unclassified using the experimenter's ratings, three who were unclassified became externalizers, one classified as an internalizer became unclassified, and one unclassified became an internalizer.

The results of these two classification schemes are presented in Table 3. This indicates that there was little practical difference whether the Pleasantness measure or the experimenter's ratings were used to identify internalizers and externalizers. The pattern of results was approximately the

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Insert Table 3 about here

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same. Internalizers showed lower self esteem, greater introversion, and greater sensitization than externalizers. No significant differences were found in intolerance for ambiguity, test anxiety, manifest anxiety, or social desirability. Internalizers had a greater tendency to describe their emotional response to the slides in impersonal terms than did the combined group of internalizers and unclassified senders ($t = 1.81$, $p < .10$ for the Pleasantness measure; $t = 2.12$, $p < .05$ for the experimenter's ratings). There was a weak tendency for internalizers as defined by the experimenter's ratings to show larger Preslide to Description Period heart rate accelerations than externalizers.

Discussion

This study demonstrated significant communication of emotion via facial expression using both the Categorization measure and the Pleasantness measure of communication accuracy. As in the previous study, the strength measure did not show significant communication. Female senders showed more accurate communication than male senders, but female observers were not reliably more accurate than male observers. The experimenter rated females as exhibiting more facial movement than males. These findings strongly suggest that the superior communication found among female pairs in the Buck et. al. (1969; in press) experiment was due to the greater facial responsiveness of the female senders.

This experiment replicated the finding of a negative relationship between facial communication and skin conductance responding for males, but the correlation for females did not attain significance. The weak negative relationship previously found between heart rate and expressiveness was also repeated, suggesting that facial responsivity may be inversely related to general autonomic functioning and

not merely to skin conductance responding. The sender's tendency to describe his emotional experience in personal terms may also be inversely related to autonomic responding.

One might argue that it is inappropriate to use the heart rate and skin conductance responses that occurred to different aspects of the experimental situation as measures of autonomic functioning. There is evidence, however, that the heart rate acceleration to the Description period and the skin conductance response to the slide are measures of autonomic functioning that are particularly appropriate to the response systems involved. Tasks involving a response, including a verbalizing response, seem to be powerful in eliciting heart rate acceleration, but not skin conductance responding (Campos and Johnson, 1967; Elliott, 1969). Arousing visual stimuli, in contrast, seem to elicit skin conductance responding more than heart rate acceleration. Possibly it is more rewarding to use measures of autonomic functioning that are appropriate to the particular response system, even though they may occur at different points in the experiment.

The tendency of males to be internalizers and females to be externalizers noted in the previous study was repeated with more pairs in this experiment, and it attained marginal statistical significance. This seems consistent with Jones's speculations about the development of internalizing and externalizing modes of response. He suggested that if overt expression of affect in a child brings social disapproval, the overt responding will be inhibited and this inhibition will in some way cause an increase in the use of hidden "internal avenues of affect discharge (Jones, 1960)." This does not specify the mechanism by which inhibition causes increased autonomic responding, but it is consistent with the tendency for males to be internalizers and females to be externalizers. In our culture, young boys are generally discouraged from overtly expressing most emotions

more than are young girls.

It might be noted that this is not true of the expression of all emotion Aggressive behavior is presumably inhibited in girls more than in boys, and there is evidence that females show less aggressive behavior (Brock and Buss, 1966) and greater skin conductance responding (Buck, 1970) than males in aggressive situations. This suggests the possibility that an internalizing or externalizing mode of response may not be a general personality attribute, but instead may be specific to certain classes of situations. A person who shows an internaling mode of response in one situation may well show an externalizing mode of response in another.

Nevertheless, there were reliable personality differences between people who used an internalizing vs. an externalizing mode of response in this study. Internalizers were higher in introversion and sensitization and lower in self esteem than externalizers, and they were more impersonal in their verbal descriptions of their emotions. Also, these differences seem generally compatible with those found in studies employing widely different methodologies. Block (1957) studied 20 "GSR reactors" and 20 "nonreactors" from a sample of 70 male medical school applicants. Among other things, the reactors were judged to be submissive, dependent, suggestible, and concerned with the appropriateness of their social behavior. Also, the reactors were thought to convert anxiety and tension into somatic symptoms more than nonreactors. Learmonth, Ackerly, and Kaplan (1959) found the skin potential reactivity of 20 female student nurses to be positively correlated with MMPI indications of the inhibition of feelings and negatively correlated with Rorshach indications of expressivity. Summarizing early studies of the relationship of electrodermal responding to overt expression, they concluded that Prideaux was correct in his 1920 statement that "the greater the visible signs of emotion...the less the response on the galvanometer (Learmonth et. al., 1959,

p. 156)." More recently, Weinstein, Averill, Opton, and Lazarus (1968) reported that subjects high in denial showed greater autonomic than self- reported arousal, while low denial subjects tended to show the opposite pattern.

One aspect of the present findings was puzzling in light of previous experiments. Internalizers were found to be "sensitizers" on the Byrne (1961) repression-sensitization scale. Previous studies have described sensitizers as persons who express their emotions freely rather than denying them (Bryne, 1961; Weinstein et. al., 1968). Clarification of the meaning of this finding must await replication and further study.

Jones's notion of internalizing and externalizing modes of response seems simple and straightforward, and it has proven useful in describing the results of this and other experiments. However, the reason why autonomic and overt responding are negatively related has not been clarified. One explanation is that the inhibition of overt behavior directly causes increased autonomic discharge in some way, although this is questioned by Jones's description of occasional "generalizers" who respond on both overt and electrodermal measures. Another possibility is that the autonomic and overt responses may not be directly related at all, but both may be related to a third variable. For example, the social learning experiences involved with inhibiting an overt response may often be stressful and threatening. This stress, and not the inhibition per se, may be associated with increased autonomic responding. Thus, when a child expresses an emotion and is rebuked by an adult, the rebuke might both inhibit the overt emotional response and increase autonomic responding. This would create a relationship between behavioral inhibition and autonomic responding without any direct causal relation between the two variables.

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Footnotes

[1]This research was supported by a grant (M-487) from the National Institute of Mental Health, and by the Commonwealth of Pennsylvania. Requests for reprints should be sent to Ross Buck, Department of Psychology, Carnegie Mellon University, Pittsburgh, Pennsylvania 15213.

Table 1. Values for the measures of communication accuracy.

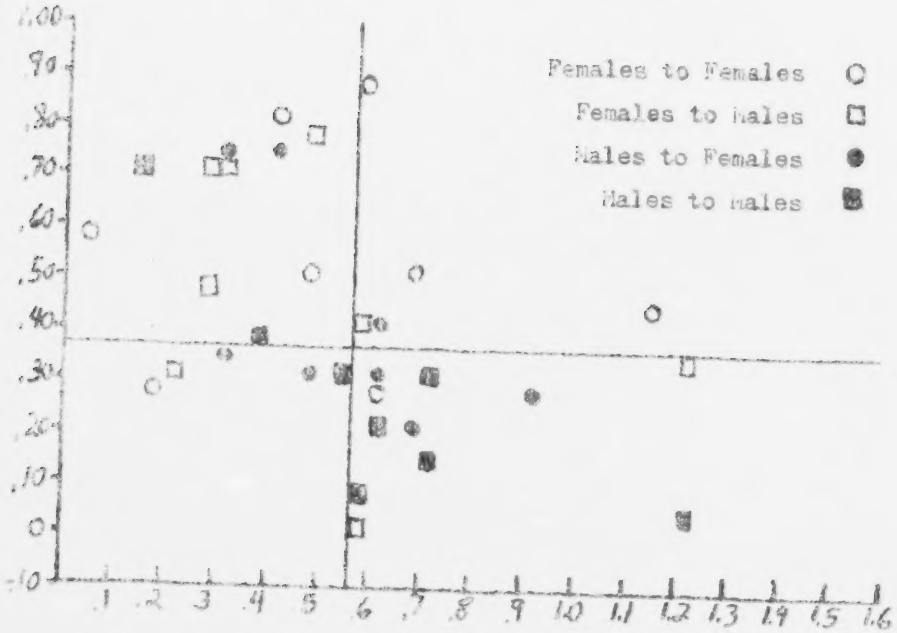
Subject Pairs	Categorization Measure	Strength Measure	Pleasantness Measure	Experimenter's Rating	
Female to Female	34.6 %***	+.18*	+.48***	3.53	
Female to Male	33.0%***	+.11	+.53***	3.68	
Male to Female	31.0%***	+.03	+.47***	2.97	
Male to Male	28.5%**	+.06	+.29***	2.92	

*$p < .025$

**$p < .01$

***$p < .001$

Fig. 1. Scatter plot between sender's skin conductance response to the slides and communication accuracy.



Change in the number of skin conductance responses from before to after the slide presentation.

Table 2. Average correlation coefficients between physiological, facial, and verbal measures.

	PM	VR	NSC	HRA
Pleasantness Measure (PM)	-	+.32*	-.50***	-.35**
Verbal Response (VR)		-	-.41**	-.26
No. of Skin Conductance Rs. (NSC)			-	+.14
Heart Rate Acceleration (HRA)				-

Note. - Averaged correlations of male and female senders computed according to McNemar (1955).

*$p < .10$

**$p < .05$

***$p < .01$

Table 3: Individual differences between internalizers and externalizers as classified both by the pleasantness measure of communication accuracy and the experimenter's rating of facial movement.

High =	Pleasantness measure				Experimenter's rating			
	Inter-nalizer	Unclassi-fied	Exter-nalizer	t Int. vs Ext.	Inter-nalizer	Unclassi-fied	Exter-nalizer	t Int. vs Ext.
Intolerant of ambiguity	39.20	36.11	35.60	NS	38.45	37.75	34.80	NS
Low self esteem	168.10	150.56	144.80	2.56**	166.82	157.50	138.90	3.14***
Extraversion	9.70	12.20	13.20	1.87*	9.81	11.44	14.00	2.19**
Sensitization	77.30	68.00	60.11	2.07*	76.73	70.86	58.60	2.22**
Facilitating Test anx.	4.60	4.00	3.10	NS	4.63	3.11	3.80	NS
Debilitating Test anx.	5.00	4.30	3.20	NS	4.90	5.56	2.10	NS
Manifest anxiety	10.20	10.30	6.50	NS	10.18	10.00	6.80	NS
Social desirability	13.80	12.70	15.20	NS	13.18	14.22	14.40	NS
Percent of slides on which verbal response w was classified "Impersonal"[a]	47.10%	23.60%	28.55%	NS	49.10%	21.20%	28.91%	NS
Heart rate acceleration (BPM)[a]	6.56	6.55	4.30	NS	7.69	5.98	4.01	1.77*

a See text
* $p < .10$
** $p < .05$
*** $p < .01$

Figure Captions

Fig. 1. Scatter plot between sender's skin conductance response to the slides, and communication accuracy (pleasantness measure).